

An Overview of Historical Beaver Management in Arizona

CHRISTOPHER D. CARRILLO, USDA, APHIS, Wildlife Services, Phoenix, AZ, USA

DAVID L. BERGMAN, USDA, APHIS, Wildlife Services, Phoenix, AZ, USA

JIMMY TAYLOR, USDA, APHIS, Wildlife Services, National Wildlife Research Center, Olympia, WA, USA

DALE NOLTE, USDA, APHIS, Wildlife Services, Fort Collins, CO, USA

PATRICK VIEHOEVER, USDA, APHIS, Wildlife Services, Phoenix, AZ, USA

MIKE DISNEY, Arizona Game and Fish Department, Phoenix, AZ, USA

ABSTRACT In the mid-1820s, Anglo-American fur trappers, known as "mountain men," entered Arizona and began trapping beaver (*Castor canadensis*). In Arizona there have been a number of famous mountain men such as Sylvester and James Pattie, Ewing Young, Jedediah Smith, and Bill Williams who trapped along the waterways in northern and southern Arizona. Although the heyday of mountain men lasted only a few decades due to a population decline of beaver, management of these animals continues to this day. The purpose of managing beavers shifted from monetary gain to controlling wildlife damage. During the late 1900s, beaver were still widely distributed in limited numbers throughout much of the state. We provide a historical overview of beaver management in Arizona with emphasis on the mountain men, recreational trapping, wildlife damage management, and beaver research in Arizona.

KEY WORDS Arizona, AZGFD, beaver, beaver damage, *Castor canadensis*, fur trappers, wildlife damage management

Historically, Arizona was geographically located within three countries: Spain (1540s to 1821), the Mexican State of Sonora (1821 to 1848) and the United States (1848 to present). In 1848, the entire state north of the Gila River became the Territory of New Mexico, part of the United States. In 1854, the area south of the Gila River was purchased from Mexico in the Gadsden Purchase. It took ten years of political maneuvering before the Arizona Territory was established in 1863. Arizona achieved statehood on 14 February 1912 (Walker 1986).

Beavers (*Castor canadensis*) are the largest rodents in Arizona and are the lightest-colored of any of the North American beaver population (Hoffmeister 1986). Beavers range along most of the major streams and numerous mountain creeks within Arizona. They are also scattered along the Colorado River,

especially in those places where there are cottonwoods and tuberous plants near the river (Hoffmeister 1986).

In the 1970s and early 1980s beaver were still widely distributed through much of the state, although not in abundance. They were absent from the western three-fourths of the Gila River, and from the Santa Cruz and San Pedro River. In Arizona there are several factors that affect the abundance of beaver. Limiting factors include lack of water and food (especially cottonwoods) from many streams and encroachment by humans (Hoffmeister 1986).

Spanish Explorers

From the onset of the early exploration of New Mexico, Spaniards had recognized the area's potential fur wealth. In 1540, the first procession of conquistadores to penetrate the southwest was led by Francisco Vasquez de Coronado who came in search of the

"Seven Cities of Cibola." This was a 6-month journey north from New Spain, as Mexico was then called. Coronado's journey brought him to Zuni villages. On this visit the natives presented him with buffalo hides and the skins of deer (*Odocoileus* spp.) and rabbits, long used by native Pueblos for footwear and clothing (Weber 1968).

In addition to the usefulness of furs as clothing, hides and skins were of value to the Plains and Pueblo tribes for trading for corn, cloth, and pottery (Weber 1968). Upon the completion of the first expedition, Coronado found the furs of little value and he felt they would not impress the viceroy or King, thereby halting the exploration of New Mexico for 40 more years.

During the 17th century, coarse furs from deer, elk (*Cervus elaphus*), bison (*Bison bison*), and antelope (*Antilocapra americana*) were among New Mexico's few exportable resources and were of such importance that the governors of the province entered and dominated the trade. Towards the end of the 17th century, trade in animal skins, like nearly all other economic activity in New Mexico, had come to an abrupt halt with the Pueblo Revolt of 1680. When the Spaniards returned in the early 18th century, the Apache were eager to reestablish the coarse-fur trade. The Spaniards also encouraged and traded with the Comanches and Utes. These Shoshonean people were previously unknown and had migrated south from southern Wyoming. With their linguistic cousins, the Utes, they soon displaced the Apaches in trade with the Spaniards. Between 1747 and 1749 the Utes had a falling out with the Comanches and joined the Spaniards against their now common enemy. By 1750, the Utes had become a more dependable source of furs (Weber 1968).

During the first decades of the 19th century, Spanish restrictions against trading to the northwest of New Mexico in Ute

territory had loosened and the attitude toward the tribal trade had changed. After the United States acquired Louisiana in 1803, Spanish officials regarded the fur trade as essential to securing friendship of Plains tribes who could serve as a buffer against encroaching Americans.

Anglo-American Fur Trappers

The first Anglo-American trappers to set foot on "Arizona" soil were Sylvester Pattie and his son, James Ohio Pattie in 1825. In the personal narrative of James Ohio Pattie, James describes his first trip with 12 men entering Arizona and trapping a section of the Gila River. On another expedition he describes a trip on the upper branches of the Gila River; Pattie and his men claimed to have caught 250 beavers of which most were used and preserved (Patti 1831).

On 3 March 1825 Pattie described trapping along the San Pedro River, tributary to the Gila River. Due to the large number of beaver, they named it "Beaver River." During the trip from 3–20 March 1825, they collected 200 beavers and turned back to the Gila River with as much fur as their "beast" could carry (Patti 1831). In 1826, the Patties returned to Arizona along the Gila River to resume trapping. However, most of the party was killed by Native Americans. Undaunted, the Patties led another party down the Gila to the Colorado River in 1827. Here the party split up and the Patties continued on to the Pacific Coast (Patti 1831).

In 1826, Ewing Young pioneered trapping the American Southwest, leading many of the first Anglo expeditions into the mountains and watercourses of today's New Mexico, Colorado, Utah, and Arizona. Ewing Young became a successful trapper and businessman, eventually setting up a trading post in Taos, New Mexico in the late 1820s. From 1826 to 1834, Ewing Young

spent considerable time trapping and trading in Arizona (Hafen 1997).

In 1826, Ewing Young along with a group of 30 men were working the Gila River and some of its tributaries. The Young party also worked up the Salt River to its junction with the Verde River. Here the party divided, part following the Verde River to its source and the other following the Salt River to its source in the White Mountains. The two groups rejoined and trapped down the Salt and Gila rivers to the Colorado River, where they enjoyed good beaver trapping (Hafen 1997).

In 1829, Young led a group of 40 trappers from New Mexico to the Salt River. They trapped down that stream and up the Verde River with considerable success. Among this group of trappers was a young Kit Carson, who had worked as a cook for Young in Taos, New Mexico, and who was now out on his first trapping expedition (Hafen 1997). After leaving the headwaters of the Verde River, the group separated, half returning to New Mexico and the rest, including Young and Carson, setting out for California.

In 1831, Young along with 36 trappers again set out for California. They stopped at the Zuni Pueblo for supplies and then trapped down the Salt River in Arizona, catching beaver in great numbers (Hafen 1997). During this expedition they had other adventures including a scrape with a grizzly bear and a fight with the Apaches.

Another legendary mountain man to enter Arizona was William Sherley "Old Bill" Williams, also known as an explorer, army scout, and frontiersman. From 1826 to his death in 1849, Williams spent time trapping alone in the "State of Senora" (Arizona). Despite spending a considerable amount of time in Arizona, little is known of Old Bill and his exploits, other than he served America honorably (Favour 1936). In 1837, Williams set out along the Colorado

River. He traveled down from what is now Bill Williams Mountain (Williams, Arizona area) through the Santa Maria Country along a stream (Bill Williams River) to the mouth of the Colorado River. During this trip Williams reported that he had "found water all along in holes and some beaver" (Clark 1965).

American Surveyors

In 1867, Dr. Elliott Coues, an American Army surgeon, historian, ornithologist and author, published "The Quadrupeds of Arizona," where he described the presence and abundance of beaver in Arizona (Coues 1867). Coues (1867) reported, "The keen pursuits of the beaver for its money value, and conspicuousness of some of its works, are in the main causes of its unusual notoriety, and of the admiration with which it is always mentioned in trappers' narratives, and naturalists' embellishments of them."

Another notable figure to be stationed with the army in Arizona was Edgar Alexander Mearns, an army surgeon and field naturalist. He developed an early interest in natural history, studying the flora and fauna around his home in Highland Falls, New York. From 1883 to 1888, he was a commissioned assistant surgeon in the medical corps of the army and assigned to duty at Fort Verde, Arizona. While stationed at Fort Verde, Mearns collected beaver specimens from a variety of locations within Arizona. All of the information he gathered while stationed in Arizona was published in the "Mammals of the Mexican Boundary of the United States." Mearns noted in his journals that beaver were evident on nearly all streams of the Colorado Basin visited by him from March 1884 to May 1888 (Mearns 1907). Mearns found the beaver to be excessively shy, secretive, and difficult of observations in contrast to the tame natured beavers he had observed in the Yellowstone

National Park (Mearns 1907). The slight amount of information respecting beavers in Arizona can be presented in the form of extracts from his diary during the years his was stationed in Arizona.

On 3 April 1887, Mearns reported that on the Box Canyon of the Verde River, beaver were numerous and had cut much of the timber along the river bank. On this trip he spoke with 1 trapper who took 120 beaver along the Gila and Verde Rivers during the winter of 1886–87, and sold the skins for \$2.50 a pound (about \$5 each; Mearns 1907). From 22–24 November 1887, Mearns reported that on the East Verde River beaver were plentiful and that there were several fine dams.

In 1894, while on the Boundary Survey, beaver were seen on the San Pedro River and on the Babocomeri Creek of the tributaries in Arizona. While on this survey, Mearns met two trappers in Yuma, Arizona. The trappers had recently arrived from a 200-mile expedition down the Gila River. They had shipped a number of beaver and raccoons taken during the trip, but found no beavers on the lower portion of the Gila River. In speaking with the residents of Adonde, Arizona, Mearns was told that beaver were scarce since the flood of 1891 (Mearns 1907).

Vernon Orlando Bailey was a field naturalist for the U.S. Department of Agriculture's Division of Economic Ornithology and Mammalogy from 1887 to 1896. In 1897 he became Chief Field Naturalist and Senior Biologist of the Department of Agriculture's Biological Survey Bureau, making many field trips throughout the west and southwest until his retirement in 1933. Bailey's chief biological interest was the study of the life history and distribution of mammals.

During his tenure with the Department he made many field trips into Arizona; most were 2 to 4 months long. In Vernon Bailey's

field notes from 1 January to 11 February 1889, he documents his travels into Utah, Nevada, and Arizona. On this trip he mentions that a few beaver were said to be present at Stone's Ferry along the Colorado River, but he only saw tracks. At Fort Mohave, the old holes of beaver lodges were present in the banks of the pond (Hoffmeister 1986). Bailey also reported that a few beaver were said to live along the Colorado River, and he saw some old stumps where they had gnawed down small cottonwoods. One trapper had told Bailey that during the winter of 1888–89 he took 80 beaver along the Colorado River between Needles, California, and Yuma, Arizona, and another 20 below Yuma, Arizona (Hoffmeister 1986).

Arizona Game and Fish Department (AGFD)

In 1917, the Arizona governor appointed the first State Game Warden to manage the wildlife resources of the state (Murphy 2005). By this time wildlife conservation practices were in place, including predator control, limited hunting seasons, establishment of game refuges, and reintroduction of some game species (Murphy 2005).

The State Game Warden published the first AGFD laws for the years 1917 and 1918. Civil penalties were established along with minimum dollar amounts. Hunting seasons were stipulated for most small game animals, but there was no closed season for furbearers, European sparrow (*Passer domesticus*), great horned owl (*Bubo virginianus*), all hawks, prairie dog (*Cynomys* spp.), and porcupine (*Erethizon dorsatum*; Murphy 2005). During this time many farmers, ranchers and homesteaders were experiencing damage from beaver and trapped them to protect their livelihood and to help make ends meet (AGFD 2006). However, in order to trap beaver, a permit

must have been secured from the State Game Warden.

One of the earliest letters to the Arizona State Game Warden was from the Salt River Valley Water Users Association on 24 December 1921. In this letter, the association requested a renewal of a permit that was issued on 7 April 1921 to trap beaver along the Arizona Canal, just west of the Granite Reef Dam. The association was again experiencing considerable trouble from this source and was requesting permission to trap beaver on the Salt River above and below Granite Reef. Other instances of beaver damage complaints were subsequently reported in 1923, 1928, and 1929. On 19 March 1929, the president of the Smithville Canal Company wrote a letter to the State Game Warden regarding beavers that were causing considerable damage to the dam at Pima, Arizona, and that they were anxious to have them removed. Moreover, on 10 July, Jesse B. Simms wrote to the State Game Warden describing the damage suffered. Mr. Simms stated "beavers have destroyed about half a crop of lettuce and are now cutting down some trees that I put out for protection of flood water."

In 1927, Governor Hunt passed a law closing the beaver season. However, the decline of beaver had begun. Damming of rivers for developing communities, bank alterations, and channelization combined with depletion of ground water resulting in reduced surface flows, had already contributed to a loss of Arizona's riparian areas (Kennedy 1997).

Beaver Reintroduction

Management practices have helped the beaver to hold its place as a member of Arizona's fauna. Since the early 20th century, AGFD has been experimenting with beaver reintroductions. One of the earliest transplants was completed by the Arizona State Game and Fish Commission, when

they introduced 12 beaver into Long Park in the Chiricahua Mountains. The beaver were trapped on the West Fork of the Black River in the White Mountains of Arizona. It was reported that the release was successful (Cahalane 1939).

On 14 January 1940, 3 beaver from Springerville, Arizona, were transplanted to South Fork Cave Creek, in the East Chiricahua Mountains. On 27 February 1940, 2 additional beavers from Pima, Arizona, were transplanted to the same area (Carr 1994). On 24 August 1950, it was reported that "four animals were trapped in the White Mountains and released" in the Graham Mountains by the Arizona Game and Fish Commission (Hoffmeister 1956).

In 1994, AGFD reintroduced beaver to a small desert stream near Wickenburg, Arizona. In 1995, the site was revisited and a recovering robust riparian habitat was found. Four beaver dams and impoundments, a lodge, and many gnawed and downed cottonwoods were located (Welch 1997). Additional beaver relocations occurred on the Bill Williams River, the San Pedro River, and Eagle Creek.

Fur prices bottomed out in the 1950s which caused trapping activities to decline. Fur prices gradually increased in the 1960s along with trapping activities. In 1976–77 there were 1,820 licensed trappers in the state of Arizona; 65 beavers, along with other predators and furbearers were trapped during this time (AGFD 2006). Increased trapping correlated with rising fur prices. However, when the fur prices peaked in the early 1980s there was an additional increase in the number of licensed trappers. In 1981–83 there were 2,219 licensed trappers who trapped 117 beavers, along with other predators and furbearers (AGFD 2006).

In 1994, leghold traps were banned on public lands in Arizona. Following the trap ban and during the trapping year 1995–96, there were only 34 licensed trappers. No

beavers were reported trapped that year. Although trapping is still legal on private lands, this event may have reduced the number of licensed trappers in Arizona to 123 during the 2005–06 season for all furbearers combined (AGFD 2006).

Wildlife Services

In 1915, the USDA, APHIS, Wildlife Services (WS) Arizona program was established, under the Bureau of Biological Survey. From the 1920s to the late 1950s, the primary focus was assisting farmers and ranchers with problems from rodents and predators. In Arizona, beaver management has been conducted to protect agriculture, property, human health and safety, and natural resources. Wildlife Services has managed beaver to prevent flooding of pastures and to protect fruit and nut trees. Near airports, beaver have been managed to prevent the creation of ponds which attract waterfowl species that create aviation strike hazards. Beaver have also been managed to prevent damage to trees on golf courses and damming of canals and irrigation devices. In addition to providing direct control, WS has been involved in multiple research projects relevant to managing beaver damage, to include experimental nonlethal techniques, attractants, electronic frightening and detection devices, habitat modification, monitoring techniques, repellents, and DNA analysis (Nolte 2003).

In 2000, the United States Army Corps of Engineers received approval from Congress to construct the Tres Rios Ecosystem Restoration and Flood Control Project in Phoenix, Arizona. In 2000, Tres Rios constructed a demonstration area onsite that used reclaimed wastewater from the 91st Avenue Treatment Plant to establish wetland habitat. Following construction, project staff identified early on that wetland construction created suitable habitat for beaver and connectivity to existing colonies.

Consequently, staff noted that excessive beaver activity was negatively impacting project goals (Taylor 2008). In 2002, Tres Rios sought help from WS in defining the extent of beaver damage and developing techniques to reduce that damage on the Tres Rios project site. Along with WS National Wildlife Research Center (NWRC), a series of research projects on the Salt River in the southwestern portion of the Phoenix, Arizona metropolitan area were initiated. The goal of these projects was to determine the possible effects beaver have on riparian and wetland habitats. A brief description of each project is provided below.

To monitor movement of beaver and estimate survival and cause-specific mortality using radio telemetry, more range was needed than internal transmitters could provide. Also, longer retention time of transmitters was needed other than what was documented in published literature. Researchers (Arjo et al. 2008) found that a modified ear-tag transmitter fitted with a plastic sleeve and attached to the tail was efficacious in pen trials. Arjo et al. (2008) also found that incorporating a neoprene washer with this setup in field trials increased retention time to over 3 times that reported previously, giving us an average deployment time of 344 days (SE=44) per tail-mounted transmitter.

Additional pen studies were conducted at the WS Olympia Field Station to develop novel nonlethal techniques for reducing beaver impacts. Harper et al. (2005) conducted pen trials to determine whether beaver could be conditioned to avoid select foods. They concluded that aversion conditioning is probably not a feasible approach to reduce beaver foraging on preferred foods.

Saltcedar (*Tamarisk* spp.) is an invasive woody plant on the Tres Rios Project site. It is rarely consumed by herbivores because it

contains high levels of tannin and sodium chloride (NaCl). Cottonwood (*Populus balsamifera*) and willow (*Salix scouleriana*) trees are preferred food sources of beaver and was the object of much damage on Tres Rios. Kimball and Perry (2008) theorized that saltcedar palatability could be improved by topical application of fructose and polyethylene glycol (PEG), and that palatability of cottonwood and willow could be reduced by application of an herbivore repellent. As predicted, they found repellent application to willow and cottonwood cuttings in combination with fructose and PEG treatment of saltcedar altered beaver plant preference. Thus, such applications may promote increased herbivory of alternative plants while reducing loss of desirable ones (Kimball and Perry 2008).

In order to protect wetlands, researchers needed to understand the movements and dispersal that may impact existing populations of beaver. Two fundamental gaps in knowledge of beaver dynamics on Tres Rios were related to their movement and genetic diversity. Beaver were not introduced to Tres Rios when the wastewater treatment project was created, thus they immigrated from populations in adjacent temporally connected wetlands.

An understanding of the origin and diversity of the population allows for improved management decisions (Taylor 2008). Thus, hair or tissue samples were collected from all beaver captured on the Tres Rios Project study area for genetic sampling. Information obtained from this data is being used to determine relatedness among individuals, population genetic structure, and genetic diversity within the population (Pelz-Serrano 2009). Results suggest that the entire Tres Rios beaver population came from a single maternal lineage.

During the Tres Rios Project, 43 adult beavers (31 females and 12 males) were

captured and radio-marked along a 8.7-mile (14 km) stretch along the Tres Rios Demonstration Project. To develop strategies to better manage the wetlands and decrease beaver damage, beaver movement was monitored with stationary dataloggers (automated radio telemetry receiving stations) and handheld receivers from 2004–2007. In analyzing data, initial evidence was found that contradicts the classic paradigm that a beaver colony consists of an adult male, an adult female, and 2 sub-adults. To support this assumption, evidence of multiple lactating females using the same den site was collected (Fischer in press).

Conclusion

In Arizona the fur trade has had a long and interesting history. Beginning in 1540 when the first Spanish explorers entered into Northern New Spain (i.e., New Mexico) the fur trade had begun. When the explorers met the tribes, they were presented with coarse furs of bison and deer as gifts. It was during these encounters that the Spaniards realized that the tribes were utilizing the furs for footwear and clothing. As the Spanish explorers learned the value of these coarse furs they began to trade with the various tribes in the region. From 1540 to the early 1800s the Spanish fur trade continued until the arrival of the Anglo-Americans.

In the mid-1820s, these Anglo-American fur trappers, known as "mountain men," entered "Arizona" from Santa Fe and Taos, New Mexico and began working the flowing waterways in what is now northern and southern Arizona. These men trapped for beaver for a few decades when the fur market and the supply of beaver declined in the 1830s. In order to continue to earn a living, some of the mountain men worked as guides for the United States Army surveyors and engineers. These men had considerable knowledge of Arizona's geography,

however little of this knowledge was recorded.

After the United States acquired what is now Arizona through the war with Mexico in 1848 and the Gadsden Purchase in 1854, Anglo naturalists descended into Arizona to survey the international boundary.

At the turn of the 19th century, commercial trapping for furs and bounties was still being conducted and many ranchers and homesteaders also trapped to protect their livelihood. During the late 1900s, beaver were still widely distributed through much of the state, but management was needed to prevent overharvest. Both the Federal Predatory and Rodent Control branch of the U.S. Biological Survey and the State of Arizona Game and Fish Commission employed professional trappers. Thus, beaver management entered the era of wildlife management.

Present populations of many wildlife species are the result of changes in environmental awareness, followed in many cases by improved legislation, sound stewardship, and successful restoration efforts (Taylor 2008). Moreover, some of the same species are managed as "nuisance" where they cause conflicts with humans. The beaver is one example of a species that was near extirpation in the United States, yet recovered following legislation and regulations (e.g., state harvest laws) and changes in use.

Management for beaver now ranges from lethal control of nuisance individuals to reintroduction of individuals for wetland restoration and to increase wildlife and habitat diversity. In many instances with management of beaver and other species, there are unclear visions of how wildlife populations may exploit resources after successful restoration or with changing landscape conditions (e.g., habitat quality and competition). With increasing anthropogenic changes to the modern-day

landscape, natural resource managers must make pragmatic decisions on the potential effects habitat alteration has on system stability. As the human population continues to grow, so will conflicts between humans and wildlife (Taylor 2008).

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